Amendments to the claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-2 (canceled). Claims 1-2 are hereby canceled without prejudice to further prosecution on the merits.

3. (Currently amended) The method of transmit antenna weight tracking as defined in Claim ~~1~~ 16, wherein the communication system comprises a DS-CDMA communication system.

4. (Currently amended) The method of transmit antenna weight tracking as defined in Claim ~~1~~ 16, wherein the determining a channel autocorrelation matrix estimate act (c) further comprises normalizing the channel autocorrelation matrix estimate.

5. (Currently amended) The method of transmit antenna weight tracking as defined in Claim ~~1~~ 16, wherein the determining a channel autocorrelation matrix estimate act (c) comprises calculating an initial forward channel autocorrelation matrix estimate.

6. (Previously presented) The method of transmit antenna weight tracking as defined in Claim 5, wherein the calculating the initial forward channel autocorrelation matrix estimate comprises determining the forward channel autocorrelation matrix estimate directly from a weight vector.

7. (Currently amended) The method of Claim ~~1~~ 16, wherein the determining a channel autocorrelation matrix estimate act (c) comprises calculating a reverse channel autocorrelation matrix estimate.

8. (Previously presented) A method of transmit antenna weight tracking in a communication system, wherein the communication system includes a transmitter and a receiver, wherein the transmitter includes a plurality of antennae, and wherein the communication system is capable of communicating utilizing a transmit adaptive antenna weighting technique, the method comprising:

a) determining a channel autocorrelation matrix estimate of a forward channel gain vector, including calculating a reverse channel autocorrelation matrix estimate; and

b) determining a transmitter antenna weight vector based on feedback from the receiver and the channel autocorrelation matrix estimate determined in the act (a), including subacts of

i) determining a perturbation vector autocorrelation matrix based on the channel autocorrelation matrix estimate determined in the act (a), including calculating the

perturbation vector autocorrelation matrix $\mathbf{R}_v$ from a forward channel autocorrelation matrix $\mathbf{R}_f$ estimate and a reverse channel autocorrelation matrix $\mathbf{R}_r$ **estimate** according to the following equation:

$$\mathbf{R}_v = 2\left(a_f \frac{\hat{\mathbf{R}}_f}{\left\|\hat{\mathbf{R}}_f\right\|} + a_r \frac{\hat{\mathbf{R}}_r}{\left\|\hat{\mathbf{R}}_r\right\|} + \left(1 - a_f - a_r\right)\mathbf{I}\right);$$

where a_f and a_r are algorithm parameters, wherein $0 \leq a_f \leq 1$, $0 \leq a_r < 1$, and $0 \leq (a_f + a_r) \leq 1$;

ii) generating a perturbation vector having an autocorrelation given by the autocorrelation matrix determined in act (i);

iii) utilizing the perturbation vector from act (ii) in a waveform transmitted from the transmitter; and

iv) utilizing a measurement of the waveform transmitted from the transmitter from act (iii) at the receiver to generate feedback.

9. (Previously presented) A method of transmit antenna weight tracking in a communication system, wherein the communication system includes a transmitter and a receiver, wherein the transmitter includes a plurality of antennae, and wherein the communication system is capable of communicating utilizing a transmit adaptive antenna weighting technique, the method comprising:

a) determining a channel autocorrelation matrix estimate of a forward channel gain vector, including calculating a reverse channel autocorrelation matrix estimate with the following sub-acts:

i) calculating a coherent channel vector estimate by multiplying a receiver waveform with a local version of a reverse channel pilot sequence conjugated and filtering the resultant with a filter to give the reverse channel vector estimate $\hat{\mathbf{c}}_r$;

ii) calculating an outer product $\hat{\mathbf{c}}_r \hat{\mathbf{c}}_r^H$; and

iii) filtering the outer product $\hat{\mathbf{c}}_r \hat{\mathbf{c}}_r^H$ to produce the reverse channel autocorrelation matrix estimate; and

b) determining a transmitter antenna weight vector based on feedback from the receiver and the channel autocorrelation matrix estimate determined in the act (a).

10. (Previously presented) A method of transmit antenna weight tracking in a communication system, wherein the communication system includes a transmitter and a receiver, wherein the transmitter includes a plurality

of antennae, and wherein the communication system is capable of communicating utilizing a transmit adaptive antenna weighting technique, the method comprising:

a) determining a channel autocorrelation matrix estimate of a forward channel gain vector, including an act of calculating an initial forward autocorrelation matrix estimate with the following sub-acts

i) calculating a coherent channel vector estimate directly from a transmit weight vector to give a reverse channel vector estimate $\hat{\mathbf{c}}_f$;

ii) calculating an outer product $\hat{\mathbf{c}}_f \hat{\mathbf{c}}_f^H$; and

iii) filtering the outer product $\hat{\mathbf{c}}_f \hat{\mathbf{c}}_f^H$ to produce the forward channel autocorrelation matrix estimate; and

b) determining a transmitter antenna weight vector based on feedback from the receiver and the channel autocorrelation matrix estimate determined in the act (a).

11. (Previously presented) A method of transmit antenna weight tracking in a communication system, wherein the communication system includes a transmitter and a receiver, wherein the transmitter includes a plurality of antennae, and wherein the communication system is capable of communicating utilizing a transmit adaptive antenna weighting technique, the method comprising:

a) determining a channel autocorrelation matrix estimate of a forward channel gain vector, including

i) calculating a reverse channel autocorrelation matrix estimate, and

ii) determining a forward channel autocorrelation matrix $\mathbf{R}_f$ estimate and a reverse channel autocorrelation matrix estimate $\mathbf{R}_r$ according to the following equations:

$$\hat{\mathbf{R}}_f(n) = \sum_{k=0}^{\infty} h_f(k) \hat{\mathbf{c}}_f(n-k) \hat{\mathbf{c}}_f^H(n-k); \text{ and}$$

$$\hat{\mathbf{R}}_r(n) = \sum_{k=0}^{\infty} h_r(k) \hat{\mathbf{c}}_r(n-k) \hat{\mathbf{c}}_r^H(n-k); \text{ and}$$

b) determining a transmitter antenna weight vector based on feedback from the receiver and the channel autocorrelation matrix estimate determined in the act (a).

12. (Previously presented) The method of transmit antenna weight tracking as defined in Claim 11, wherein $h_r()$ and $h_f()$ are causal estimation filters with unit DC gain according to the following equation:

$$\sum_{k=0}^{\infty} h_r(k) = \sum_{k=0}^{\infty} h_f(k) = 1.$$

13. (Previously presented) The method of transmit antenna weight tracking as defined in Claim 12, wherein the causal estimation filters are exponential filters that can be represented by the following equation:

$$h(k) = \begin{cases} 0 & k < 0 \\ (1-\lambda)\lambda^k & k \geq 0 \end{cases}.$$

14. (Canceled). Claim 14 is hereby canceled without prejudice to further prosecution on the merits.

15. (Currently amended) The method of transmit antenna weight tracking as defined in Claim ~~14~~ <u>16</u>, wherein exponentiations of autocorrelation matrices are adjusted to expand or compress a tracking rate.

16. (Currently amended) ~~The method of transmit antenna weight tracking as defined in Claim 14,~~ <u>A method of transmit antenna weight tracking in a communication system, wherein the communication system includes a transmitter and a receiver, wherein the transmitter includes a plurality of antennae, and wherein the communication system is capable of communicating utilizing a transmit adaptive antenna weighting technique, the method comprising:</u>

<u>a) selecting different first and second perturbation vectors, wherein a perturbation vector is a vector that temporarily modifies a previously determined transmitter antennae weight vector to create a test weight vector;</u>

<u>b) determining a new transmitter antennae weight vector based at least in part on feedback from the receiver that reflects a comparison between receptions of different signal sets, including</u>

<u>i) a first signal set transmitted during one or more first time periods that is a source signal as weighted by a first test weight vector based on an old transmitter antennae weight vector as perturbed according to the first perturbation vector, and</u>

<u>ii) a second signal set transmitted during one or more second time periods that is substantially the same source signal as weighted by a second test weight vector based on the old transmitter antennae weight vector as perturbed according to a different second perturbation vector;</u>

<u>c) determining a channel autocorrelation matrix estimate of a forward channel gain vector; and</u>

<u>d) determining a transmitter antenna weight vector based on feedback from the receiver and the channel autocorrelation matrix estimate determined in the act (c), wherein the act (d) comprises the following sub-acts:</u>

i) determining a perturbation vector autocorrelation matrix based on the channel autocorrelation matrix estimate determined in the act (c), wherein the sub-act (d)(i) of determining a perturbation vector autocorrelation matrix comprises the following sub-acts:

(1) calculating a forward channel autocorrelation matrix estimate;

(2) calculating a reverse channel autocorrelation matrix estimate; and

(3) generating the perturbation vector autocorrelation matrix from the estimates calculated in the sub-acts (1) and (2);

ii) generating a perturbation vector having an autocorrelation given by the autocorrelation matrix determined in the act (d)(i);

iii) utilizing the perturbation vector from the act (d)(ii) in a waveform transmitted from the transmitter; and

iv) utilizing a measurement of the waveform transmitted from the transmitter from the act (d)(iii) at the receiver to generate feedback; and

wherein the generating the perturbation vector autocorrelation matrix sub-act (3) generates the perturbation vector autocorrelation matrix $\mathbf{R}_v$ from estimates of forward and reverse autocorrelation matrices $\mathbf{R}_f$ and $\mathbf{R}_r$ by the following equation:

$$\mathbf{R}_v = 2\left(a_f \frac{\hat{\mathbf{R}}_f{}^p}{\left\| \hat{\mathbf{R}}_f{}^p \right\|} + a_r \frac{\hat{\mathbf{R}}_r{}^p}{\left\| \hat{\mathbf{R}}_r{}^p \right\|} + \left(1 - a_f - a_r\right)\mathbf{I} \right);$$

where a_f and a_r are algorithm parameters, wherein $0 \le a_f \le 1$, $0 \le a_r \le 1$ and $0 \le (a_f + a_r) \le 1$.

17. (Previously presented) The method of transmit antenna weight tracking as defined in Claim 16, wherein the method utilizes eigendecompositions to generate the perturbation vector autocorrelation matrix.

18. (Previously presented) The method of transmit antenna weight tracking as defined in Claim 17, wherein the forward channel autocorrelation matrix $\mathbf{R}_f$ estimate and the reverse channel autocorrelation matrix $\mathbf{R}_r$ estimate are represented by the following equations:

$$\hat{\mathbf{R}}_f = \mathbf{Q}_f \Lambda_f \mathbf{Q}_f^H; \text{ and}$$

$$\hat{\mathbf{R}}_r = \mathbf{Q}_r \Lambda_r \mathbf{Q}_r^H;$$

where the matrices $\mathbf{Q}$ are comprised of eigenvectors of corresponding matrices $\mathbf{R}$; and matrices Λ are diagonal, containing eigenvalues of $\mathbf{R}$.

19. (Previously presented) The method of transmit antenna weight tracking as defined in Claim 18, wherein the forward channel autocorrelation matrix estimate and the reverse channel autocorrelation matrix estimate are modified by exponentiation represented by the following equations:

$$\hat{\mathbf{R}}_f{}^p = \mathbf{Q}_f \Lambda_f{}^p \mathbf{Q}_f^H \text{; and}$$

$$\hat{\mathbf{R}}_r{}^p = \mathbf{Q}_r \Lambda_r{}^p \mathbf{Q}_r^H .$$

20. (Currently amended) The method of transmit antenna weight tracking as defined in Claim ~~14~~ 16, wherein the forward channel autocorrelation matrix $\mathbf{R}_f$ estimate and the reverse channel autocorrelation matrix $\mathbf{R}_r$ estimate jointly generate a modified matrix represented by the following equation:

$$\hat{\mathbf{R}}_{f,r}{}^p = \left(a_f \frac{\hat{\mathbf{R}}_f}{\left\| \hat{\mathbf{R}}_f \right\|} + a_r \frac{\hat{\mathbf{R}}_r}{\left\| \hat{\mathbf{R}}_r \right\|} \right)^p = \mathbf{Q}_{f,r} \Lambda_{f,r}{}^p \mathbf{Q}_{f,r}^H .$$

21. (Currently amended) The method of transmit antenna weight tracking as defined in Claim ~~14~~ 16, wherein the generating the perturbation vector autocorrelation matrix sub-act (3) generates the perturbation vector autocorrelation matrix $\mathbf{R}_\mathbf{v}$ from estimates of the forward autocorrelation matrix $\mathbf{R}_\mathbf{f}$ and the reverse autocorrelation matrix $\mathbf{R}_\mathbf{r}$ by the following equation:

$$\mathrm{R}_\mathrm{v} = 2 \left(a_f \frac{\hat{\mathrm{R}}_\mathrm{f}}{\left\| \hat{\mathrm{R}}_\mathrm{f} \right\|} + a_r \frac{\hat{\mathrm{R}}_\mathrm{r}}{\left\| \hat{\mathrm{R}}_\mathrm{r} \right\|} + \left(1 - a_r - a_f\right)\mathrm{I} \right)^\mathrm{p} .$$

22. (Previously presented) The method of transmit antenna weight tracking as defined in Claim 21, wherein the method utilizes eigendecompositions to generate the perturbation vector autocorrelation matrix.

23. (Previously presented) The method of transmit antenna weight tracking as defined in Claim 22, wherein the forward channel autocorrelation matrix estimate and the reverse channel autocorrelation matrix estimate are represented by the following equations:

$$\hat{\mathbf{R}}_f = \mathbf{Q}_f \Lambda_f \mathbf{Q}_f^H \text{; and}$$

$$\hat{\mathbf{R}}_r = \mathbf{Q}_r \Lambda_r \mathbf{Q}_r^H ;$$

where the matrices $\mathbf{Q}$ are comprised of eigenvectors of corresponding matrices $\mathbf{R}$; and

matrices Λ are diagonal, containing eigenvalues of **R**.

24. (Previously presented) The method of transmit antenna weight tracking as defined in Claim 23, wherein the forward channel autocorrelation matrix estimate and the reverse channel autocorrelation matrix estimate are modified by exponentiation represented by the following equations:

$$\hat{\mathbf{R}}_f{}^p = \mathbf{Q}_f \Lambda_f{}^p \mathbf{Q}_f^H \text{; and}$$

$$\hat{\mathbf{R}}_r{}^p = \mathbf{Q}_r \Lambda_r{}^p \mathbf{Q}_r^H .$$

25. (Currently amended) The method of transmit antenna weight tracking as defined in Claim ~~1~~ 16, wherein the channel autocorrelation matrix estimate of a forward channel gain vector is based on a receiver position/environment data.

26. (Previously presented) The method of transmit antenna weight tracking as defined in Claim 25, wherein the receiver position/environment data comprises angle of arrival.

27. (Previously presented) The method of transmit antenna weight tracking as defined in Claim 25, wherein the receiver position/environment data comprises angular spread of a channel.

28. (Previously presented) The method of transmit antenna weight tracking as defined in Claim 25, wherein the receiver position/environment data comprises geographical position of a mobile station.

29. (Previously presented) The method of transmit antenna weight tracking as defined in Claim 28, wherein an angle of arrival is based on the geographical position of a mobile station.

30. (Previously presented) The method of transmit antenna weight tracking as defined in Claim 28, wherein the geographical position of a mobile station is based on Global Positioning System (GPS) data.

31. (Canceled). Claim 31 is hereby canceled without prejudice to further prosecution on the merits.

32. (Currently amended) The apparatus as defined in Claim ~~31~~ 34, wherein the determining a transmitter antenna weight vector means (d) further comprises:

i) means for determining a perturbation vector autocorrelation matrix based on the means (c);

ii) means, responsive to the means (d)(i), for generating a perturbation vector having an autocorrelation given by the means (d)(i);

iii) means, responsive to the means (d)(ii), for utilizing the perturbation vector from the means (ii) in a waveform transmitted from the transmitter; and

iv) means, responsive to the means (d)(iii), for utilizing a measurement at the receiver of the waveform transmitted from the transmitter to generate feedback.

33. (Canceled). Claim 33 is hereby canceled without prejudice to further prosecution on the merits.

34. (Currently amended) ~~The apparatus as defined in Claim 33,~~ Apparatus that performs transmit antenna weight tracking in a communication system that includes a transmitter and a receiver, wherein the transmitter includes a plurality of antennae, and the communication system is capable of employing a transmit adaptive antenna weighting technique, comprising:

a) means for selecting different first and second perturbation vectors, wherein a perturbation vector is a vector that temporarily modifies a previously determined transmitter antennae weight vector to create a test weight vector;

b) means for determining a new transmitter antennae weight vector based at least in part on feedback from the receiver that reflects a comparison between reception of different signal sets, including

i) a first signal set transmitted during one or more first time periods that is a source signal as weighted by a first test weight vector based on an old transmitter antennae weight vector as perturbed according to the first perturbation vector,

ii) a second signal set transmitted during one or more second time periods that is substantially the same source signal as weighted by a second test weight vector based on the old transmitter antennae weight vector as perturbed according to a different second perturbation vector;

c) means for determining a channel autocorrelation matrix estimate of a forward channel gain vector, wherein the means for determining a channel autocorrelation matrix estimate of a forward channel gain vector further comprises means for calculating a reverse channel autocorrelation matrix estimate; and

d) means, responsive to the means (c), for determining a transmitter antenna weight vector based on feedback from the receiver and the channel autocorrelation matrix estimate determined by the means (c); further

including means for ~~calculating~~ determining a perturbation vector autocorrelation matrix $\mathbf{R}_v$ from a forward channel autocorrelation matrix $\mathbf{R}_f$ and a reverse channel autocorrelation matrix $\mathbf{R}_r$ according to the following equation:

$$\mathbf{R}_v = 2\left(a_f \frac{\hat{\mathbf{R}}_f}{\left\|\hat{\mathbf{R}}_f\right\|} + a_r \frac{\hat{\mathbf{R}}_r}{\left\|\hat{\mathbf{R}}_r\right\|} + \left(1 - a_f - a_r\right)\mathbf{I} \right);$$

where a_f and a_r are algorithm parameters, wherein $0 \le a_f \le 1$, $0 \le a_r < 1$, and $0 \le (a_f + a_r) \le 1$.

35. (Original) The apparatus as defined in Claim 34, wherein the determining a perturbation vector autocorrelation matrix means comprises:

(1) means for calculating a forward channel autocorrelation matrix estimate;

(2) means for calculating a reverse channel autocorrelation matrix estimate; and

(3) means, responsive to the forward channel autocorrelation matrix estimate means and the reverse channel autocorrelation matrix estimate means, for utilizing eigendecompositions to generate the perturbation vector autocorrelation based on estimates from the forward channel autocorrelation matrix estimate means and the reverse channel autocorrelation matrix estimate means.

36. (Currently amended) The apparatus as defined in Claim ~~31~~ 34, wherein the determining a perturbation vector autocorrelation matrix means comprises:

i) means for calculating a forward channel perturbation vector autocorrelation matrix utilizing eigendecompositions; and

ii) means for calculating a reverse channel perturbation vector autocorrelation matrix utilizing eigendecompositions.

37. (Currently amended) A communication system, capable of performing a transmit adaptive antenna weighting technique in accordance with the method of Claim ~~46~~ 16, comprising:

a) a transmitter capable of:

i) determining a channel autocorrelation matrix estimate of a forward channel gain vector;

ii) determining a perturbation vector autocorrelation matrix based on the channel autocorrelation matrix estimate;

iii) generating a perturbation vector having an autocorrelation associated with the perturbation vector autocorrelation matrix; and

iv) determining a weight vector that is based on the perturbation vector and a TxAA algorithm that incorporates a feedback from a receiver; and

b) a receiver, capable of:

i) receiving a signal based on the perturbation vector; and

ii) generating feedback based on the signal.

38. (Previously presented) The apparatus as defined in Claim 37, wherein a plurality of transmitters transmit to the receiver when the receiver is in soft handoff.

39. (Original) The apparatus as defined in Claim 38, wherein the plurality of transmitters transmit information regarding multiple antenna transmission to each other via a backhaul.

40. (Original) The apparatus as defined in Claim 39, wherein the plurality of transmitters transmit information regarding positioning to each other via a backhaul.

41. (Canceled). Claim 41 is hereby canceled without prejudice to further prosecution on the merits.

42. (Currently amended) The transmitter as defined in Claim ~~41~~ 44, wherein the channel autocorrelation matrix estimator comprises a forward channel autocorrelation estimator, capable of calculating a forward channel autocorrelation matrix estimate.

43. (Canceled). Claim 43 is hereby canceled without prejudice to further prosecution on the merits.

44. (Currently amended) ~~The transmitter as defined in Claim 43,~~ A transmitter configured to weight signals according to weighting vectors adaptively adjusted for transmission to a target receiver via a plurality of antennae, comprising:

A) means for selecting different first and second perturbation vectors, wherein a perturbation vector is a vector that temporarily modifies a previously determined transmitter antennae weight vector to create a test weight vector; and

B) means for transmitting different test signal sets, including

i) a first test signal set transmitted during one or more first time periods that is a source signal as weighted by a first test weight vector, wherein the first test weight vector is based on an old transmitter antennae weight vector as perturbed according to the first perturbation vector, and

ii) a second test signal set transmitted during one or more second time periods that is substantially the same source signal as weighted by a second test weight vector based on the old transmitter antennae weight vector as perturbed according to the different second perturbation vector; and

C) means for determining a new transmitter antennae weight vector based at least in part on feedback from the target receiver that is treated as reflecting a comparison between reception of the first and second test signal sets; further comprising:

a) a channel autocorrelation matrix estimator, capable of estimating a channel autocorrelation matrix of a forward channel gain vector; wherein the channel autocorrelation matrix estimator further includes a reverse channel autocorrelation matrix estimator capable of calculating a reverse channel autocorrelation matrix estimate;

b) a perturbation vector autocorrelation matrix calculator, responsive to the channel autocorrelation matrix estimator, capable of determining a perturbation vector autocorrelation matrix based on the channel autocorrelation matrix estimate;

c) a perturbation vector generator, responsive to the perturbation vector autocorrelation matrix calculator, capable of generating a perturbation vector having an autocorrelation associated with the perturbation vector autocorrelation matrix; and d) a weight vector calculator, responsive to the perturbation vector generator, capable of determining a weight vector that is based on the perturbation vector and a TxAA algorithm that incorporates a feedback from the receiver

wherein the reverse channel autocorrelation matrix estimator comprises:

i) a coherent channel vector estimator, capable of calculating a coherent channel vector estimate $\hat{\mathbf{c}}$ by multiplying a receiver waveform with a local version of a reverse channel pilot sequence conjugated and filtering the resultant with a filter;

ii) an outer product calculator, responsive to the coherent channel vector estimator, capable of calculating an outer product $\hat{\mathbf{c}}\hat{\mathbf{c}}^H$; and

iii) a filter, responsive to the outer product calculator, capable of filtering the outer product $\hat{\mathbf{c}}\hat{\mathbf{c}}^H$ to produce the reverse channel autocorrelation matrix estimate.

45. (Currently amended) The transmitter as defined in Claim ~~41~~ 44, wherein the channel autocorrelation matrix estimator comprises:

i) a forward channel autocorrelation matrix estimator, capable of calculating a forward channel autocorrelation matrix estimate utilizing eigendecompositions; and

ii) a reverse channel autocorrelation matrix estimator, capable of calculating a reverse channel autocorrelation matrix estimate utilizing eigendecompositions.

Claims 46-48 (canceled). Claims 46-48 are hereby canceled without prejudice to further prosecution on the merits.